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Abstract
(December 1988) - Pit-Ridge Nest Construction and Spawning Behavior of Semotilus lumbee and Semotilus thoreauianus. By W.S. Wollcott and E.G. Maurakis, 2 pp.

A Need for Clarification of the Concept of Nest Building Among Cyprinid Minnows. By W.S. Wollcott and E.G. Maurakis, 1 p. plus Curatorial Notes and News Notes.

Keywords
fishes, spawning, nest construction, smotilus lumbee, semotilus thoreauianus

Southeastern Fishes Council
PROCEEDINGS
DEDICATED TO THE PRESERVATION OF SOUTHEASTERN FISHES

Number 18 December 1988

Pit-Ridge Nest Construction and Spawning Behaviors of *Semotilus lumbee* and *Semotilus thoreauianus*

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Pit-ridge nest construction is unique to only the males of three species of chubs *(Semotilus atromaculatus, Semotilus lumbee and Semotilus thoreauianus)* (Maurakis and Loos, 1984; Maurakis and Kahnke, 1987). *Semotilus lumbee* (Sandhills Chub) and *S. thoreauianus* (Thoreau's Chub) have limited ranges on the periphery of the range of *S. atromaculatus* (Creek Chub), which occurs throughout eastern and central United States and southeastern Canada. *Semotilus lumbee* is restricted to headwaters of Coastal Plain streams of the Cape Fear, Little Peedee, and Peedee River drainages in the Carolina Sandhills in North Carolina and South Carolina (Snelson and Suttkus, 1978). *Semotilus thoreauianus* is in small streams above and below the Fall Line from the Savannah River drainage in northwestern South Carolina to the Pearl River drainage in southeastern Louisiana (Johnston and Ramsey, 1985).

Our observations of the breeding behavior of *S. atromaculatus* conform to those depicted in Reighard (1910) and Ross (1976; 1977a,b). Using data from direct field observations and video recordings, we describe the habitats and activities associated with nest construction and the spawning behaviors of *S. lumbee* and *S. thoreauianus*, both sibling species of *S. atromaculatus*.

Materials and Methods

Stream width and depth, and dimensions of nests were measured with a meter stick; water current (m/sec) with a Marsh-McBirney meter; and water temperature with an alcohol Celsius thermometer. Fishes were collected with a pulsed DC backpack electroshocker. Nest construction and reproductive behaviors were photographed in color with three types of cameras (35 mm; industrial grade Panasonic video camera; and a Sony television camera).

Results and Discussion

Semotilus lumbee and *S. thoreauianus* constructed pit-ridge nests in gravel reaches of 1st and 2nd order creeks similar to those of *S. atromaculatus* (Table 1). Nests were located in tails of pools, either in midstream or nearshore, with a nearby cryptic refuge (e.g. undercut bank). In both species, the nest began as a pit built by a single dominant male. After the male spawned with a female, it excavated pebbles from the downstream end of the pit and placed them over the eggs deposited in the upstream end of the pit. Thus, as spawning proceeded, a ridge of deposited material was formed which increased in length and continually displaced the pit downstream. Pit size remained relatively constant even though the rear margin of the pit was subjected to continual downstream excavation. Fine sand, dislodged during the digging, formed the downstream rim of the pit.

Dimensions of the ridge and pit varied with size of the male, duration of spawning, and stream characteristics (Table 1). The structure of the nest caused eddies to be formed within the pit perimeter, which enabled the non-adhesive eggs to sink into the gravel of the pit. For example, an active nest of *S. thoreauianus* in a creek (flow = 0.023 m^3/sec) exhibited the following velocities: 7.7 cm/sec above and below the nest; 10.6 cm/sec at the posterior end of the ridge; 2 cm/sec at the front of the pit; and 5.7 cm/sec at the rear of the pit.

Dominant males of *S. lumbee* and *S. thoreauianus* were observed spawning during the day at minimum water temperatures of 13.9 C (25 April 1982) and 17.0 C (13 April 1986), respectively (Table 1). Cephalic tuberculation of *S. thoreauianus* is the same as that of *S. lumbee*, which is reported for the latter by Snelson and Suttkus (1978). Also, the coloration of breeding males of the two species was consistent with the description

given by Snelson and Suttkus for *S. lumbee* (dusky olivaceous body dorsum, rosy-orange side intensifying to orange toward the head, and pinkish-orange pectoral fin).

Spawning of the two species was similar. The dominant male took a position at the head of the pit. A female either drifted tail first over the upstream rim of the pit as described by Ross (1976) for *S. atromaculatus* or entered from the back side of the pit. Spawning took place when a female aligned parallel with the male. The male, with his pectoral fin under the breast of the female and his caudal peduncle over her back forces her head up and her tail down resulting in the spawning clasps as described by Reighard (1910) for *S. atromaculatus*. Smaller females were usually thrown toward the surface whereas larger ones were rolled to the side.

Whether engaged in pit excavation, ridge building, or spawning the dominant male stayed in or near the pit guarding the nest for extended periods. Agonistic displays in the form of parallel swims with other comparable sized adult males usually occurred upstream of the nest. The dominant male also made short aggressive lunges toward other species that were near the nest.

There are no known nest associates (i.e. species that use a nest for spawning but do not contribute to its formation) in streams inhabited by *S. lumbee*. We observed one nest associate (*Notropis rubricroceus)* over a *S. thoreauianus* nest. Other potential nest associates of *S. thoreauianus* are *Hybopsis rubrifrons* and species of *Notropis* and *Campostoma*.

Acknowledgements

Thanks are expressed to J. Goodin, J. Kahnke, M. King, J. Loos, and T. Orrell for their assistance with the field work, and to G. Grossman for his review of the manuscript. The studies were supported in part by a grant from the Richard Gwathmey and Caroline T. Gwathmey Memorial Trust, a University of Richmond Faculty Research Grant, a Student Research Grant from the George Washington University Chapter of Sigma Xi, and a loan of video equipment from Potomac Electric Power Company.

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Table 1. Physical characteristics associated with pit-ridge nests of *Semotilus lumbee*, *Semotilus thoreauianus* and *Semotilus atromaculatus.*

Parameter		*lumbee*	*thoreauianus*	*atromaculatus*
No. of streams		3	8	9
No. of nests		8	12	18
No. of males		3	3	16
Dominant Males (SL mm)		170-200	68-102	127-200
Stream width (m)		1.98-2.1	1.5-3.0	1-9
Flow (m3/sec)		0.16-0.18	0.023	
Current (cm/sec)		10-29	11-13	10-40
Water Temperature (C)		13.9-16.1	17-17.5	12.1-26.7 (1,2)
Nest Length (m)		0.9-1.6	0.5-1.1	0.7-2.25
Ridge	Height (cm)	12.7-18.3	3.5-10	5-7.6
	Width (cm)	30-61	12-30	25-30
	Length (cm)	50.8-120	5-70	30-460
Pit	Depth (cm)	6.3-8.2	4-9	5-20
	Width (cm)	25-40.6	19-30	20-31
	Length (cm)	35.6-38	20-40	20-61

1. Scott and Crossman (1973)
2. Breder and Rosen (1966)

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A Need for Clarification of the Concept of Nest Building Among Cyprinid Minnows

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The complex reproductive behavior of constructing well-defined pebble or rock nests (i.e. pit, pit/ridge and pit/mound) by the overt movement of substrate material with the use of the jaws of adult male chubs before and after the spawning act is considered an advanced evolutionary trait (reference to *Nocomis*, Lachner and Jenkins, 1971). It is limited to the species of four North American cyprinid genera (*Campostoma, Exoglossum, Nocomis, and Semotilus*). Excluded from this concept are the behaviors of minnows that form depressions with their fins during the act of spawning, e.g. that of *Rhinichthys atratulus*; or, as described by Raney (1940), that of minnows that may rarely pick up small stones in their mouths before spawning, e.g. *Notropis cornutus*.

Because of the uniqueness of pebble nestbuilding behavior and consequently its evolutionary significance in Cyprinidae, misunderstanding leading to misinterpretation may result if authors fail to clearly define their meaning when referring to nest-building minnows. For example, from a translation on life history aspects of some Asian minnows by Nakamura (1969), Gosline (1978) reports "*Opsariichthys* and *Zacco* are nest-building cyprinids and in this respect, differ from most or all members of the cultrine stock." A thorough and precise translation of Nakamura (1969) failed to identify these fishes as nest builders. Actually, the English equivalent of nest is used only once (p. 242), but it is in reference to ovaries of ripe females rather than to spawning nests. There is a statement that might be construed as a reference to a use of a nest where breeding pairs of *Zacco temminckii* go to a "spawning spot." Further, Nakamura describes the migration of adult *Opsariichthys uncirostris* from Lake Biwa upstream into tributaries where they move into shallows to spawn over gravel or sand. He says that a cone-shaped concavity is made in the substrate as a result of the spawning activity of *O. uncirostris*. The elongated anal fin of the male makes "gravel into a scoop" that receives fertilized eggs. This type of nest is comparable to the depressions made by *R. atratulus* during the spawning act and is substantially different from the pebble nest of North American nest-building cyprinids.

Acknowledgments

We thank David C. Evans, Professor of Japanese History and his assistant, Junko Uzuhashi, of the University of Richmond for a punctilious translation of Nakamura's paper.

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CURATORIAL NOTES

Museum Jar Closures

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A weak experiment, sans replicates, was conducted to determine the suitability of various closures of jars used to store alcoholic fish specimens. Four different containers and 10 different closures were used. A description of the closures and the results of the experiment are given in Table 1. Containers 1 through 7 were 4 oz Paragon flint glass jars measuring approximately 48 x 112 mm. Container number 8 was similar but measured approximately 40 x 128 mm, and numbers 9 and 10 were glass vials measuring approximately 21 x 70 mm and 28 x 58 mm respectively.

Each container and its closure was weighed on a Mettler P 162 balance to the nearest 1/100 gram, then partially filled with 95 percent ethyl alcohol, fitted with a closure, weighed again, and then placed on a shelf in the University of Alabama Ichthyological Collection (UAIC) range on 22 January 1981. The test jars remained undisturbed until 16 January 1987 when they were weighed again in order to determine the weight loss, which would represent the loss of alcohol due to evaporation from the containers.3rd year of the test.

Table 1. Description of closure and the amount of alcohol evaporated from various containers over a six year period.

Description of closure	Weight of alcohol in grams 1981	1987	Percent loss
1. Bakelite, cardboard liner	28.02	20.52	26.74
2. Bakelite, cardboard liner and shrink band	28.83		100.00
3. Bakelite, hard polyethylene liner	26.41	9.82	62.80
4. Polypropylene, cardboard liner	38.54	38.38	0.40
5. Polypropelene, soft polyethylene liner and shrink band	36.99	34.43	06.93
6. Polypropylene, soft polyethylene liner	31.07	27.52	11.42
7. Polypropelene, no liner, shrink band	37.76	29.80	21.10
8. Bakelite (40 mm), polyethylene cone liner	30.12	30.05	0.32
9. Bakelite (21 mm), polyethylene cone liner	10.99	10.98	0.06
10. Polypropeline (25 mm), polyethylene cone liner	15.74	15.64	0.58

Clearly small caps with polyethylene cone liners are superior to those with either cardboard or regular flat polyethylene liners. Polypropylene caps are superior to bakelite caps. The bakelite caps, subject to greater expansion and contraction as temperatures vary, tend to "back off." The soft (spongy) polyethylene liners probably are better overall than cardboard, although closure number 4 (polypropylene cap with cardboard liner) performed better in this limited test than did number 6 (polypropylene cap with polyethylene liner). In the case of closure number 2, the cellulose shrink band cracked and fell off, the bakelite lid "backed off," and the alcohol evaporated sometime during the 2nd and

3rd year of the test.

The information related herein is of limited value since each test closure was not replicated a number of times with jars of various manufactures. The results do confirm my suspicion that almost any closure is better than the bakelite cap with a cardboard or hard polyethylene liner. I think that much of the problem of "leaky" jars is in the jars themselves. The rims of many jars are not true, ie., the rim does not have an even contour. As a test, place a 4 oz molded glass jar, open end down, on a hard surface. Press down and try to "rock" the jar. If the rim is not true the jar will "rock." Hard liners, such as solid polyethylene, cannot conform with the irregularities of the rim, and therefore do not become "seated" well enough to form a leak-proof seal.

The cellulose shrink bands, the kind you see on jars containing chemicals, are not a solution to the problem of keeping bakelite caps on jars. They tend, after a few years, to become brittle and loose; thus, offering no protection against the cap "backing off." It may be the expansion of the bakelite cap itself that loosens or breaks the cellulose band.

The closure you select is an important decision as curator of an alcoholic collection. The best containers, I think, are the bail-type jars with rubber gaskets. However, the old red rubber gaskets manufactured for use with Atlas and Ball jars (no longer manufactured) were not made to last for many years. Since they have to be stretched to fit the jar rim, they "rot" rather rapidly. Also, they become "grooved" and should be replaced each time the jar is opened. Since the domestic bail-type jar selection is so limited, and the foreign jars so expensive, we must look for a suitable screw-cap jar. Overall, I think, the most practical closure for 4 oz thru 32 oz jars is the polypropylene cap with the cardboard or soft polyethylene liner.

We at UAIC are in the process of fitting our screw-cap jars with the polypropylene-ethylene closure. It is an expensive move but far less costly than losing specimens to dehydration. At today's prices, I estimate conservatively that the average replacement cost for *each* fish specimen in your collection is two dollars. This estimate is based on my experience with ichthyological surveys and it includes the cost of travel, supplies, equipment, labor, preservatives and containers (but not the cost of storage space, shelves, and the labor for perpetual care).

The value of a zoological object is not the dollar amount that it will bring on the open market, but the cost of replacing it, if indeed it can be replaced at all. The fish specimens in your collection are invaluable and unique documents. A collection of fishes and the accompanying field data are analogous to the books in a library. Each lot is a document containing untold knowledge. Each document deserves the best care we can afford it.

Note: "bakelite" is a trademark for synthetic resin and plastic made from formaldehyde and phenol, and apparently discovered by the Belgian-born American chemist, L.H. Bakelite (1863-1944).

A Painless Way of Detecting Formalin

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In 1948-49 when the University of Alabama Ichthyological and Herpetological Collections were first established, all specimens were fixed and retained in 10 percent formalin. As the economic picture improved, we began in the early 1960's to transfer specimens to 70 percent ethanol. The transfer was done rather haphazardly because the availability of alcohol was inconsistent and our priorities regarding what specimens were to become alcoholic changed frequently. Consequently, relatively few ich specimens and many herps are still in formalin. Since the sight test for formalin is unreliable, and the "sniff" test unhealthy and downright unpleasant, we searched for and found a safe and reliable test for the presence of formaldehyde that can be performed in the stacks. Thinking that other curators may be faced with this problem, we relate herein our suggestion for solving it.

Schiff's reagent, highly sensitive to aldehydes, has not, to our knowledge, been employed by curators of liquid preserved specimens as a test for formaldehyde. A few drops of preservative suspected of containing formalin is mixed with a drop of Schiff's reagent. If formalin is present the mixture will immediately turn pink or magenta, depending on the strength of the formalin. No color change indicates that the test solution is completely free of aldehyde.

Some curators do not attempt to remove completely the original formalin fixative before transferring specimens to alcohol. In fact, we doubt that all original fixative could be removed from a specimen. The original formalin fixative that leaks into the alcohol preservative is detectable, but the reaction takes longer to show the presence of the formalin. We suggest that the user experiment with formalin solutions of known strength before making tests in the stacks.

To avoid the hassle of pipetting preservatives and reagent, you can use filter paper soaked in Schiff's reagent just as you would use litmus paper. Dampen filter paper with Schiff's reagent, place the paper in the refrigerator until it is dry. Cut the paper into chips and store in covered petri dish in the refrigerator. Handle the paper with forceps. As you take a jar suspected of containing formalin from the shelf, splash some preservative on the lid liner, remove the lid and touch the liquid with the indicator paper. The paper will suddenly turn from white to magenta if formalin in present.

A light pink color could indicate residual formalin from the original fixative. Wipe the cap liner clean of the reagent lest you end up with pink specimens. Never introduce Schiff's reagent into specimen bottles.

To make Schiff's reagent:

1) Dissolve 1 gram basic fuchsin in 100 ml water. Heat to dissolve.
2) Cool solution.
3) Add 20 ml 1 N HCl, and 1.7 grams sodium metasulfide ($Na_2S_2O_5$) and stir for several hours.
4) Add about 4 or more grams of charcoal (acid-washed "Norit A"), stir 5-10 minutes and filter. If necessary, add more charcoal, stir and refilter until the filtrate is completely colorless.
5) Store reagent in a dark bottle in the refrigerator.

Schiff's reagent is stable to storage for several years; however, we have no information regarding the stability of the indicator paper.

MINUTES

1988 Business Meeting
Southeastern Fishes Council

The Southeastern Fishes Council meet a Biloxi, Mississippi in the Ship Island Room of the Biloxi Hilton on April 15, 1988. Chairman Robert E. Jenkins presided. The meeting was called to order at approximately 4:24 PM, CDT.

Secretary's Report: The Minutes of the 1987 meeting were read and approved.

Treasurer's Report:

		Balance
Checking account (rec'd from previous Treasurer)		$ 623.04
Assets:		
1988 dues rec'd at at 1987 meeting	60.00	
1988 dues rec'd as of 4/12/88	670.00	
Donations as of 4/12/88	120.00	
	850.00	1473.04
Debits:		
Cost of Issue No. 17 of PROCEEDINGS	(385.01)	
Service charge on checking account	(1.41)	
	(386.49)	1086.55
Balance in Checking Account (4/12/88)		1086.55
Paine Webber Cash Fund (3/23/88)		1645.74
Total Assets (4/1/88)		$2732.19

Editors Report:

Mike Stevenson reported that in the past year he had received a sufficient number of manuscripts to produce one issue of the PROCEEDINGS. He distributed information for contributors and requested that individuals submit manuscripts. Upon acceptance of a manuscript for publication the author(s) will receive Galley proofs prior to printing. Reprints are available for a nominal fee.

Mike also indicated that back issues of most issues of the PROCEEDINGS are available. Individuals wishing to receive copies should contact Mike at: Dept. of Biological Sciences, Univ. of New Orleans, New Orleans, LA 70148. Old fish buttons are also available.

Several questions from the floor were heard regarding the type of style which will be employed in the future and the number of typographical errors in issue No.17. Mike indicated that the small type style used in issue no. 17 will be employed for future printings. He also acknowledged some mistakes had been made and noted that steps would be taken to correct these problems.

Old Business:

The subject of a new "Natural History Journal" as an outlet for manuscripts on fishes remains a possibility. Discussion on this topic continued for several minutes. It was noted that the editors of Copiea are investigating the possibility of converting to some form of "Desk Top Publishing." This should decrease the amount of time to get an article published and also reduce costs.

Jim Williams noted that the problem was not one of cost or time for publication. Rather, it is a matter of an outlet for natural history notes. Several individuals commented on the need for a new journal and the apparent views (either real or perceived) of the Copeia editors regarding these types of manuscripts.

At the conclusion of comment of this issue Bob Jenkins stated that he would write to the North Carolina State Museum to inquire if they had any plans regarding publication of such a journal.

New Business:

Bob Cashner informed the members of a letter he received from Steve Plantania regarding a "4th of July fish count." The Desert Fishes Council has been conducting a fish count for a number of years and they would like to request that the SFC begin a similar project. (Following the minutes is a summary paraphrasing Steve's letter.)

Regional Reports:

Regional reports were presented by the following individuals and copies will be mailed to Mike Stevenson for publication in the PROCEEDINGS.

Region 1, North East, Bob Jenkins

Region 2, South East, Carter Gilbert

Region 3, North Central, David Etnier (by Bob Jenkins)

Region 4, South Central, Rick Mayden

Region 5, North West, Henry Robison (by Bob Jenkins)

Region 6, South West, Bob Cashner (with additions by R.D. Suttkus)

At the conclusion of the Regional Reports, Jim Williams made some comments regarding developments pertaining to exotics. The Rudd (*Scardinius erythrophthalmus*) has been imported into Arkansas by bait fish farmers. Last October, during flooding, this species escaped into the local streams. Florida and Alabama have now passed laws specifically limiting this species. Many other states have laws limiting importation of exotics, however, there appears to be some question as to how these apply to bait fish. Recently North Dakota indicated that they wish to introduce *Lucioperca* (zander). There is evidence that this species could tolerate warm water and therefore move downstream to Memphis or Baton Rouge.

After some discussion regarding regulations governing collecting permits Bob Jenkins stated he will write all states for information on collecting permits.

The 1989 meeting will be held in Charlotte, NC with ASB, April 5-9. In 1990 we will meet the ASIH in Charleston, SC.

The meeting ended at 6:05 PM.

Respectfully Submitted

W. Wieland
Secretary/Treasurer

OPEN LETTER TO SFC MEMBERS

From: Steven P. Platania
To: Interested Parties

28 March 1988

At the 1987 Desert Fishes Council meeting in Hermosillo, Mexico, a special symposium on monitoring of fish populations was held. The main reoccurring theme throughout the session was the need for annual systematic monitoring of fish populations throughout the southwest.

It was suggested that one possible way to conduct such a program was to initiate a census similar to the ornithologists' Christmas Bird Count. This idea has received the support of the Desert Fishes Council and we are going to try to initiate it in 1988.

Each participant should select one or two sites, preferably close to where they live or work, for sampling. Remember, the idea is that this/these same site/sites will be collected each successive year during the census period.

Our goal for the first year of this fish count is to have at least two different individuals sampling in different sections of each of the states covered by the Desert Fishes Council (hopefully more). We too will use a holiday as the focal point of our count and at several peoples suggestions, have picked the 4th of July. In order to allow plenty of time for collections to be made you will have three weekends around which sampling could be performed (June 27 – July 11).

There are certainly a number of questions, which I have not addressed and I hope to do that in the next letter. In the meantime, give this project some thought as I am open to any and all suggestions. Also, if you have a suggestion for what we should call this endeavor, let me know.

REGIONAL SFC REPORTS

REGION 1 – North East

The Roanoke logperch *Percina rex* , was originally petitioned by N.M. Burkhead for threatened status nationally. The U.S. Fish and Wildlife Service deems it worthy of endangered status; the process of its formal enlistment is well underway. In the same petition the orangefin madtom, *Norturus gilberti*, was also considered to merit threatened status, but the USFWS judged it does not warrant federal status.

Conferral of status to the Roanoke logperch and designation of much of upper Roanoke River and its main forks as critical habitat would protect much of the distinctive, specios upper Roanoke icthofauna. That fauna currently is threatened by a proposed reservoir on a small Roanoke River tributary near Salem. The purpose of the reservoir, planned by Roanoke County authorities, is storage of drinking water that is to be

pumped from the main river, including during times of certain low-river levels. Noel Burkhead and an active conservation group, Friends of the Roanoke River, have been integral in evaluation of proposed water withdrawal levels, such that the Virginia Department of Game and Inland Fisheries, the Army Corps of Engineers and the USFWS caused Roanoke County planners to reduce projected river withdrawals.

In fall, 1988, the Virginia Department of Game and Inland Fisheries will hold a symposium on Virginia biota needing protection. A major publication is expected to result. R.E. Jenkins is on the Steering Committee for the symposium and chairs the Fishes Committee. The VDGIF recently made a computer analysis of vertebrates to determine species to be protected. As a result the following five species have officially been added to the state endangered list: *Ennecanthus chaetodon, Etheostoma acuticeps, E. collis, E. jessiae,* and *E. tippecanoe*. Additional species on the Virginia list are those already federally protected. Notable is that the Roanoke logperch is not included by the VDGIF, perhaps pending federal listing, nor is the orangefin madtom.

A manuscript describing the rare duskytail darter is being completed by R. E. Jenkins. This species merits either threatened or special concern status nationally.

The Cape Fear shiner, *Notropis mekistocholas,* is about to be federally designated endangered.

E. F. Menhinick's book on the freshwater fishes of North Carolina soon will be published by the N. C. State Museum of Natural History. Ed published (1987. J. Elisha Mitchell Sci. Soc. 102 (2): 54- 86) an interesting numerical method for ranking jeopardized freshwater fishes.

The bridle shine, *Notropis bifrenatus,* a species that has declined or disappeared in certain southern parts of its range, Virginia and North Carolina, has been found in a reservoir of the Santee drainage, South Carolina, by Peter Coleman of the Charleston Museum.

R. Jenkins

REGION 3 – North Central

Madtom transplants

We enter our third year of transplanting fingerling *Noturus baileyi* and *N. flavipinnis* from Citco Creek to lower Abrams Creek. The technique is to find nests by snorkeling, rob those with late embryos and/or emerged larvae, and culture in aquaria, feeding live *Daphnia artemio* and mosquito larvae. There is no significant mortality early on, but again, at the stage when schooling behavior breaks down, mortality becomes a severe problem. We solved it to some extent this year by stocking earlier as smaller fish, and this year we will attempt to solve the late mortality problem by (1) providing more space per fish after schools breakup and (2) providing a wider variety of food. After at that time we stocked about 100 of each species last spring. No positive results are expected realistically, until 1986-87 when the transplants reach sexual maturity, spawn,and produce a year-class. Members of this class should be large enough to see late in their first summer. The North Fork of the Holston River (VA & TN) is being considered for 1989 transplants of *N. flavipinnis*.

R.E. Mayden and crew captured and released a presumptive snail darter from other Little River below Mill Dam at Melhose, ca 20 river miles upstream from TN 33 bridge, where the only other Little River *P. tanasi* was collected. Rumors abound considering its actual identity with juvenile logperch currently attracting the bulk of the smart money.

Long awaited descriptions of 3 *Ulocentra (zonistium, pyrrhogaster, flavorum)* should be available within the year (Univ. Mich pubs.). *E. (Nothonotus) wapiti* (Proc. Bio. Soc. Wash.) might also make it in '88, but Etnier's lack of tact has led to an uncomfortable situation with the editorial staff.

Phoxinux sp. (cf. *oreas*) of the upper Tennessee drainage is now considered a distinct species by Starnes and Jenkins (Proc. Bio. Soc. Wash.). Description, as *P. tennesseensis,* expected in 1988.

Except for the last 20 pages and Lit. Cited, the Tennessee Fish book is back to typist, the ms. plus corrections/additions is being transferred to IBM Word Star. Hopefully, entire text (with sample range maps, color and black and white photos) will go to UT Press this spring. Range maps and a few pen and ink illustrations to accompany keys need to be completed. Volunteers are needed to review various chapters!

Peggy and Randy Shute plus John Tullock have opened an aquarium shop, Aquatic Specialists, in west Knoxville, TN. Marine, brackish, and freshwater fishes, marine inverts, and freshwater outdoor ponds are included. Looks like it will fly. Certain investors (Etnier, Rick LeDuc) hope so. The former maintains a morgue which periodically gets incorporated into the UT collection.

The TN aquarium in Chattanooga is a go and will emphasize native species from "the mountains to the Mississippi". The plans look fantastic, starting with Blue Ridge stream and forest and ending in cypress swamps with intervening warm-water streams, rivers vs. reservoirs, Coastal Plain streams, and etc.

The search for *Fundulus abolineotus* in the lower bend of Tennessee River failed to discover any specimens. An excellent new population of *Etheostoma tuscumbia* was found in north Alabama, in a spring pond below water supply for New Hope, Mountain Fork Creek system, Madison Co.

D. Etnier

REGION 5 - North West

The following represents the information I was able to gather for "my" report at the S.E. Fishes Council meeting next week. I was able to talk with Bill Matthews but unable to reach Bill Pflieger in Missouri.

Oklahoma

Notropis girardi, the Arkansas River shiner, will be proposed for Federal listing as "Threatened Status" due to the rapid decline of this species throughout its native range. Two items seem primarily responsible for this rapid decline in the past 15 years. First, replacement of *N. girardi* by *N. bairdi* rorm the Red River has occurred; however, the prime factor seems to be the regulation of flows in the Arkansas River by the large dams which decreases the reproductive success of *N. girardi*.

The only remaining stronghold for *N. girardi* seems to be in the lower South Canadian River (Bill Matthews, pers. comm.).

General News:

a. Oklahoma does have an official state list of threatened and endangered fishes.

b. *Etheostoma radiostum* (orangebelly darter) systematic study by Bill Matthews reveals no new subspecies contrary to earlier reports.

c. Paul James, OSU graduate student, is studying the reproductive habits of the leopard darter, a federally threatened species.

Arkansas

The Ozark Cavefish, *Amblyopsis rosae*, has officially been placed on the federal threatened list. The Ouachita madtom, *Notropis lachneri*, is in the review process federally.

Notes

General News:

a. The *Fishes of Arkansas* by Henry Robison and Tom Buchanan will be published by the Unversity to Arkansas Press in June. The book will be 608 pages with black and white or color photos of all 215 species inhabiting the state. Cost will be $50.00 for cloth cover; $30.00 for paper.

b. Robison continues work on *Cottus carolinae* west of the Mississippi with Dick Robins.

c. Matthews and Robison have completed a multivariate analysis of the distribution of native Arkansas fishes based on 2323 collections from the last 20 years.

Missouri

Pflieger and Robison continue work on an undescribed form of *Etheostoma flabellare* in the White River system of Missouri and Arkansas.

H. Robison

NEWS NOTES

Citizens' Guide to Wetlands Protection – Ms. Wendy Wagner of Wyoming, MI has begun a popular guide to wetlands ecology and their usefulness in order to provide citizens with information enabling them to participate more fully in governmental decisions affecting wetland resources. Her concentration at this time is on the states of Alabama, Georgia and North and South Carolina. A similar guide now exists for the state of Virginia. She is requesting any information you may have and wish to contribute to this effort. You may contact her at 2780 Woodlake Apt. #4. This project is underwritten by the Southern Environmental Law Center in Charlottesville, VA.

Conservation Awards – The seven winners of Chevron's Conservation Awards in the southeast are listed below. The Conservation Awards Program is the oldest privately-sponsored program of its kind in the United States. The honorees will receive $1,000 cash award and a bronze plaque commemorating their achievements. "These honorees have displayed an ability to work cooperatively with government, business, other conservation organizations and the media to make their personal goals a reality. In their own way, each has selflessly devoted time, expertise and resources to protecting the vital elements of our environment."

MARYLAND – **The Chester-Sassafras Foundation, Inc.,** Chestertown – a grass roots organization that pre-

serves and balances the Chesapeake Bay area's need for economic growth with its ecological needs.

MISSOURI – **Mr. Greg F. Iffrig,** Springfield – a natural areas coordinator with the state's Department of Natural Resources, developed the State Park Stewardship Program, including a model savanna restoration stewardship plan.

Pat and Edward Jones, Jr., Williamsburg – formed and funded a private foundation that enables underprivileged youth to experience the rewards of conservation efforts. They also contributed the funds for the rights fee needed to protect a 200-mile stretch of abandoned railroad along the Missouri-Kansas-Texas border — the same route taken by Lewis and Clark.

Mr. G. Andy Runge, Mexico – A lawyer, for applying his legal expertise to conserving the state's wildlife, forest, fish, soil and water resources. His work resulted in the enactment of state sales taxes, the funds from which are used to support conservation of natural resources.

TEXAS – **Mr. Perry R. Bass,** Fort Worth – for helping achieve passage of The Wildlife Conservation Act during his Chairmanship with the Texas Parks and Wildlife Commission, which now possess wildlife conservation legislation and manages the state's natural resources.

Sportsmen's Club of Texas, Inc. Austin – the states largest nonprofit conservation organization, which for three decades has been an active force for all facets of conservation, including the establishment of 37,000 acres of wildness within Texas's four national forests.

VIRGINIA – **Boone and Crockett Club,** Dumfries, the nation's oldest conservation organization, for its continuing mission as a supporter of legislation enhancing our system of national parks, monuments, forests and game refuges.

Information on nominating procedures can be obtained by writing to: Chevron Conservation Awards, P.O. Box 7753, San Francisco, California 94120-7753.

North American Native Fishes Association (NANFA)

This organization was founded to bring together people interested in fishes native to this continent for scientific purposes or aquarium study; to encourage increased scientific conservation, and aquaristic appreciation of native fishes through observation, study, and research; and to assemble and distribute information on native fishes. Additionally, this organization publishes *American Currents* a 10 issue/year magazine of information collecting, maintaining, breeding and conserving North American fishes. They also document endangered, threatened or special status species and provide a directory of native fish articles appearing in aquarium publications. Membership cost $11/yr. Mail application inquires to: Robert E. Schmidt, Simon's Rock, Alkford Rd., Gt. Barrington, MA 01230.

International Conference on Constructed Wetlands for Wastewater Treatment – This conference was held 13-16 June 1988 in Chattanooga, TN. Anyone desiring information may contact the Wetland Conference Coordinator, 7601 West Summit Hill Drive, Old City Hall Building, Knoxville, TN 37902, (615) 632-4645.

The Delaware Estuary: Rediscovering A Forgotten Resource – A new book from the University of Delaware Sea Grant College Program, oversized, softbound, 150 pages including historical and color photographs, maps, graphs, and species identification guides. Price is $20 from University of Delaware Sea Grant Communications, 196 South College Avenue, Newark, DE 19716.

Fishes of Arkansas – This publication by Henry W. Robison and Thomas M. Buchanan is now available from The University of Arkansas Press, Fayetteville, 72701. Price is $50 cloth and $30 paper plus $1.50 shipping.

The Directory of National Environmental Organizations – The third edition of this directory lists addresses and descriptions of over 375 non-governmental conservation organizations including the Southeastern Fishes Council. Hardbound, updated to mid-1988, organized into 40 major environmental subject areas. Cost is $35 ppd from: US Environmental Directories, P.O. Box 65156, St. Paul, MN 55165.

Walleye Alert – It has been discovered by Brian Murphey and associates at Texas A & M University Wildlife and Fisheries Dept. that a genetically unique population of walleye exists in the Tenn-Tom system in Luxapolila Creek. In sampling walleye from over 15 states, this population is the only one fixed for all electrophoretic loci sampled. Additional details will be forthcoming in a note to be published in the next PROCEEDINGS. Discussions regarding the conservation status of this form will be welcomed during our April meeting.

SFC Meeting – Our business meeting will be held in conjunction with ASB at UNC Charlotte, NC 4-5:15 PM, Friday, 7 April in the Olmsted Room of the Hilton at University Place.

State of the Journal – I have four manuscripts in backlog to hopefully be coming out in May, 1989 as Number 19. The following is an outline regarding manuscript preparation. Longer papers (>5 pages) and shorter notes should be in the same format.

Southeastern Fishes Council PROCEEDINGS

Information for Contributors

The primary intent of the PROCEEDINGS is to publish research papers, critical reviews of problems, area reports and other pertinent information pertaining to the biology and conservation of Southeastern fishes.

Manuscripts should be submitted in duplicate with the original on good quality bond paper. A good guide for manuscript preparation is the *Fifth Edition of the CBE Style Manual* (1983) available from the Council for Biology Editors, 9650 Rockville Pike, Bethesda, Maryland 20814.

The entire manuscript including the abstract (if desired), text, Literature Cited, tables, headings and legends must be double-spaced. The title, author's name and author's address should be centered on the first page. Indicate a suggested running head of less than ten words at the bottom of the text. Acknowledgements will be cited in the text immediately before the Literature Cited. All references cited in the paper will follow the standard format of using the last name of the author(s) followed by the year alphabetical by the author's last name and chronological under a single authorship. The entire reference should be given with the complete name of the journal spelled out if possible.

Tables should be typed on a separate page, consecutively numbered and should have a short descriptive heading. Figures (to include maps, graphs, charts, drawings and photographs) should be consecutively numbered and if grouped as one figure each part block lettered in the lower left corner. In general, high quality prints or photocopies are preferred to the original line art. Legends for figures must be on a separate sheet and each figure must be identified on the back. The desired location of each table or figure should be indicated in the margin of the manuscript.

Manuscripts will be subject to editing and will be reviewed by a least one person expert in the subject matter. The edited manuscript and page proofs ("galley") will be furnished to the author. Reprints will be available at a nominal cost.

Regional reports, news notes and other short communications will also be edited and included when possible in the next number.

Only manuscripts from members of the Southeastern Fishes Council will be considered for publication. There is no charge for publishing in the PROCEEDINGS. All manuscripts and short communications should be sent to the editor of the PROCEEDINGS:

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PROCEEDINGS

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